

## REMARKS

The Office Action mailed 29 September 2009, has been received and its contents carefully noted. Claims 1-6 and 9-10 were pending and claims 1-6 and 9-10 were rejected. Claims 7 and 8 were withdrawn from consideration. By this amendment, claims 1, 5, 7 and 9 have been amended and claims 3 and 4 have been canceled. Support may be found in the specification and the claims as originally filed. No statutory new matter has been added. Therefore, reconsideration and entry of the claims as amended are respectfully requested.

### Rejection under 35 U.S.C. 103(a)

The Examiner rejected claims 1-6 and 9-10 under 35 U.S.C. 103(a) as unpatentable over Hennige (US 20040038105).

Applicants respectfully submit that Hennige does not teach or suggest the present invention as claimed. Specifically, Hennige discloses a porous and flexible ceramic membrane which is modified to have ionic liquid in the pores to have the ion-conducting properties and as a result of the use of the ionic liquid which is contained in the pores of the membrane, the membrane of Hennige can have very good proton/cation conductivity even at temperature above 100 °C. Although, Hennige teaches that organic and/or inorganic ion-conducting material can be contained in the pores of the membrane and it also teaches that the ion-conducting material is at least one compound selected from phosphates, phosphides, phosphonates, sulfates, sulfonates, sulfoarylphosphonates, and mixtures of these compounds with least one of the elements Al, Si, P, Sn, Sb, K, Na, Ti, Fe, Zr, Y, W, Mo, Ca, Mg, Li, Cr, Mn, Co, Ni, Cu, or Zn, Hennige does not teach or suggest the use of solid ion conductor wherein sulfoalkyl or sulfoaryl groups are inserted in (crystalline) metal phosphate layers.

According to the present invention, as claimed, the proton-conducting polymer membrane employs a solid ion conductor which has a layered structure and has sulfoalkyl or sulfoaryl groups inserted in crystalline metal phosphate layers of the conductor. Additionally, the metal of the metal phosphate is a Group IV metal, such as zirconium phosphate. The Group IV metal bonds to three oxygen atoms and forms a monoclinic system and a phosphate group located at the tetrahedral site functions as crosslinkage, thereby forming a layered structure. Further, the phosphate group offers a space in which six water molecules can be held and the water molecules

inserted between the layers form hydrogen bonds to P-OH groups, so that the layered structure is maintained by van der Waals' force. Accordingly, the layered metal phosphate has superior thermal properties and chemical resistance.

On the other hand, Hennige teaches the use of an ionic liquid which is contained in the pores of the membrane to give good proton/cation conductivity even at temperature above 100 °C. Hennige merely discloses conventional organic/inorganic ion-conducting materials. Nowhere does Hennige teach or suggest sulfoalkyl or sulfoaryl groups inserted in metal phosphate layers where the metal is a Group IV metal. The conventional materials of Hennige, e.g. phosphate, phosphide, phosphonate, etc., or a mixture with a metal such as Al, Si, P, Sn, etc. cannot form a layer structure.

Thus, nowhere does Hennige teach or suggest a proton-conducting polymer membrane wherein 1 to 40 parts by weight of ionomer/solid proton conductor having sulfoalkyl or sulfoaryl groups inserted in metal phosphate layers of the ionomer/solid proton conductor wherein the metal is a group IV metal is dispersed in 100 parts by weight of proton-conducting polymer having proton-exchanging groups in side chain or its advantages, i.e. good conductivity at temperatures above 100 °C.

Therefore, Applicants respectfully assert that the claims, as amended, are unobvious and the rejection under 35 U.S.C. 103(a) should properly be withdrawn.

### **Request for Rejoinder**

Applicants respectfully request rejoinder of the method claims, claims 7 and 8, which have been amended to be of similar scope to claim 1 (as claim 7 depends thereon) which is believed to be allowable.

### **Request for Interview**

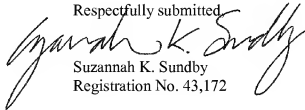
Either a telephonic or an in-person interview is respectfully requested should there be any remaining issues.

### CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Therefore, it is respectfully requested that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Official action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

It is not believed that extensions of time are required, beyond those that may otherwise be provided for in accompanying documents. However, in the event that additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. 1.136(a), and any fees required therefor are hereby authorized to be charged to **Deposit Account No. 024300**, Attorney Docket No. **034225.002**.

Respectfully submitted



Suzannah K. Sundby  
Registration No. 43,172

Date: 1 March 2010  
SMITH, GAMBRELL & RUSSELL, LLP  
1130 Connecticut Ave., NW, #1130  
Washington, D.C. 20036  
Telephone: (202) 263-4332  
Fax: (202) 263-4352  
ssundby@sgrlaw.com